departments of instruction of the new institution shall provide specialised courses in mining and metallurgy, and that department shall be called and known by the name of 'The Royal School of Mines,' and the governing body shall award the diploma of 'Associate of the Royal School of Mines' to any student who completes such courses to the satisfaction of the governing body." The individuality and history of the school will thus be preserved, and will not be sacrificed in what the chairman called a jumble. In conclusion, Mr. McKenna expressed the hope that though, in joining a larger association, the school necessarily will sacrifice a certain amount of individuality as a governing body, nevertheless by retaining the name and the diploma it will be compensated for any respect in which it may suffer by the advantages which will accrue from the fuller and more complete equipment. The name and the fame of the Royal School of Mines must be kept bright as a star in the firmament of the new institution, which is to be a pioneer even to Germany in the work of scientific training

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, December 13, 1906.—"An Examination of the Lighter Constituents of Air." By J. E. **Coates**. Communicated by Sir William Ramsay, F.R.S.

About 73,000 litres of air were systematically fractionated in order to ascertain whether any constituent lighter than hydrogen (*e.g.* coronium) were present. A preliminary concentration of the lighter portions was effected by collecting the gas which had passed repeatedly through an air-liquefying plant, precautions being taken to avoid contamination of the gas with hydrogen. By fractionation of the liquefied gas, a light portion having a volume of about 4700 c.c. was obtained, which was further fractionated by absorption in charcoal at about −205° C. The lightest fractions thus obtained were examined spectroscopically, but no lines were detected which could not be attributed to hydrogen, helium, and neon. The volume of hydrogen amounted to 0·778 c.c., while the total volume of neon and helium obtained was 46 c.c. Assuming that 60,000 volumes of air contain one volume of mixed neon and helium, it appears that hydrogen is present in the air to the extent of one part in about a million and a half. This estimate has been subjected to a correction for the solubility of hydrogen in liquid air, an approximate correcting factor being obtained by performing the fractionations on a sample of air to which a known small quantity of hydrogen had been added. This is much smaller than previous estimates; it seems probable that hydrogen is a variable constituent of the atmosphere.

January 31.—"A Recording Calorimeter for Explosions." By Prof. Bertram **Hopkinson**. Communicated by Prof. H. L. Callendar, F.R.S.

This paper describes a method of recording the heat lost up to any instant after an explosion of coal-gas and air in a closed vessel. For this purpose the vessel, which was cylindrical, and about 1 foot in diameter and 1 foot long, was lined first with a wooden backing ¼-inch thick and then with a continuous length of copper strip ¼-inch wide by 1/25-inch thick. The strip was wound helically on the cylindrical part of the vessel, and the two end-plates were covered with parallel pieces joined up at the ends so as to form an electrically continuous length.

The method consists in recording the rise of resistance of the whole length of copper strip when the explosion takes place. The rise of resistance is proportional to the rise of mean temperature of the strip. Hence, knowing the heat capacity of the copper, the total heat that has passed into it at any instant can be obtained from the record, after making certain corrections for the heat which has passed from the copper into the backing and into those parts of the walls which are not protected by the copper.

The record of resistance was obtained by passing a known current (about 8 amperes) through the strip, and recording the potential at the terminals of the strip by means of a reflecting galvanometer having a period of about 1/15th of a second. The galvanometer was placed in series with a constant source of E.M.F. of such magnitude as to balance the E.M.F. at the terminals of the strip when cold; the galvanometer deflection was then proportional to the rise of E.M.F. between the terminals of the strip, and so to the rise of resistance. The galvanometer mirror reflected an image of a fine hole illuminated by an arc lamp on to a photographic film carried on a revolving drum. A photographic record of the pressure in the vessel was obtained at the same time on the same film.

The mixture used consisted of one part of coal-gas and about seven parts of air at atmospheric pressure and temperature. It was fired by an electric spark at the centre of the vessel. To test the accuracy of the calorimeter, the heat which had passed into the walls at the end of one second from firing was calculated from the record, and was found to be 10,000 calories. The temperature of the gas at that moment was found from the pressure record to be 545° C. Using Holborn and Austin's values for the specific heats of the constituents up to that temperature, the heat remaining in the gas was calculated to be 3800 calories. The total heat accounted for by the calorimeter and pressure records is therefore 13,800 calories, and this should be equal to the heat of combustion of the coal-gas used. This was the case within 2 per cent.

The calorimeter record shows that during about two-fifths of a second after firing the rate of heat loss to the walls at any moment is approximately inversely proportional to the square root of the time. That is, the law of heat loss is initially the same as that of a solid at uniform temperature the boundary of which is suddenly cooled. It is pointed out that the rate of cooling is conditioned mainly by the state of the surface layer of gas in contact with the walls; at first heat is drawn from that layer, and the loss of heat is very rapid, but when the surface layer has been cooled down it acts as heat insulation for the remainder, and further cooling is relatively slow.

Linnean Society, February 21.—Prof. W. A. Herdman, F.R.S., president, in the chair.—The Percy Sladen Trust Expedition to the Indian Ocean in 1905 under Mr. J. Stanley Gardiner. (1) Description of the expedition. (i.) Introduction; (ii.) history and equipment of the expedition; (iii.) *résumé* of the voyage and work. Part i., Colombo to Mauritius: J. Stanley **Gardiner** and C. Foster **Cooper**.—(2) Land nemerteans, with a note on the distribution of the group: R. C. **Punnett**. A single land nemertean obtained by Mr. Stanley Gardiner in the Seychelles must be referred to a new species, and has accordingly been named *Geonemertes arboricola*. The specific name has reference to the peculiar habitat of the worm, which occurs, among other places, in the leaf-bases of the screw-pine, *Pandanus hornei*.—(3) Land Crustacea: L. A. **Borradaile**. The collection contained thirty species, belonging to eleven genera. None were new to science, and all had previously been reported from the Indian Ocean. The fauna revealed by the collection is richer than that of the Maldives and Laccadives, but otherwise closely resembles it.—(4) Hymenoptera: P. **Cameron**. Thirty-two species of the group were obtained, ants being excepted. Of these, seventeen are described as new, one, *Tolbia scaevola*, as the type of a new genus. Ten species were obtained from the Chagos, three being new; and twenty-three from the Seychelles, including Coetivy, eleven new, the fauna for this archipelago now consisting of twenty-four species. As regards the habits of the species, it is suggestive that so many of them belong to genera (Evania, Ampulex, Sphex, Notogonia, &c.) of which many, if not most, of the species prey on Orthoptera.—(5) Dragon-flies: F. F. **Laidlaw**. The collection contains fourteen species, none of which are new. All were obtained in the Seychelles, and four in the Chagos as well. It is suggested that the species peculiar to the Seychelles are a fragment of an endemic fauna which is being displaced throughout the whole Indo-African region by an invading fauna from the north.—(6) Fourmis des Seychelles, Amirantes, Farquhar et Chagos, déterminées par H. A. **Forel**. Nous avons pour les divers groupes d'îles en question 8 espèces cosmopolites, 8 espèces malgaches,

8 formes locales, qui ont toutes dans leur dérivation un caractère malgache; trois formes locales (sous-espèces ou variétés) dérivées d'espèces indomalaises; une espèce océanienne; une espèce américaine évidemment importée et ayant un peu varié; puis deux formes communes aux archipels mais l'une au moins décidément dérivée malgache. Enfin, une espèce (*Pheidole punctulata*) et une sous-espèce (*Camponotus grandidieri*) tout communes aux faunes africaine et malgache, probablement dérivées de la première.—(7) Pycnogonida: Prof. G. H. **Carpenter.** Only five species of the group were obtained, of which four are described as new. The most remarkable is a Colossendeis from 450 fathoms off the Saya de Malha Bank.—(8) Aves: Dr. H. F. **Gadow,** F.R.S., and J. Stanley **Gardiner.** The birds obtained were in no way remarkable, being mostly waders or regular sea-birds of wide distribution. The crab-plover (*Dromas ardeola*) was found everywhere. Of economic importance as guano-formers were breeding colonies of *Fregata ariel* on Nelson Island, Chagos, *Sula piscator* on St. Pierre, *Sterna fuliginosa* and *Anous leucocapillus* on Cargados Carajos, and *Pelecanus crispus* and *Puffinus tenuirostris* on St. Joseph, Amirante Islands.

Society of Chemical Industry, March 4.—Mr. R. J. Friswell in the chair.—Five years' experience in measuring and testing producer gas: R. **Threlfall,** F.R.S. The first part of the paper is devoted to a *résumé* of the principles and construction of the instruments employed in Pitot tube gas measurement. This is followed by a description of the "static" method of measuring gas density. An account is then given of the results of balancing the make and distribution of producer gas over a period of several years, this being illustrated by curves which show that an agreement within about 2 per cent. can be attained in practice. The next section of the paper is devoted to a discussion of the theory and practice of measuring pulsating streams of gas or air, such, for instance, as are produced by pumping by gas-engines or otherwise. As to the question of sulphur in producer gas, it is shown that the referee's test is less suitable for this purpose than a modification of Valentine's test. The discussion of this matter covers both the determination of sulphuretted hydrogen and of total sulphur, and it is shown that it is fatal to the sulphuretted hydrogen to employ a gas meter containing water—no matter how long it may have been in action. The best methods hitherto proposed and practised for the determination of the volume of gas produced per ton of coal, otherwise than by the author's meters, are considered critically, and some examples are given of the results of balancing on carbon and on ammonia. The paper ends with a note on the determination of producer temperatures by a system of thermocouples which are read by a potentiometer suitably divided to read direct, and fed by a very large Clark or cadmium cell.

Zoological Society, March 5.—Mr. F. Gillett, vice-president, in the chair.—The discovery, in cave deposits in Crete, of remains of elephants, some of which represent a new species: Miss D. M. A. **Bate.**—Report on the Polyzoa of the third Tanganyika expedition: C. F. **Rousselet.** Five species were represented in the collection, three of which were described as new. Of the five species, three belonged to the Phylactolæmata and two to the Gymnolæmata. Amongst the latter was *Arachnoidia raylankesteri,* Moore, which was found in some abundance on shells dredged from deep water.—Report on the Brachyurous Crustacea of the third Tanganyika expedition: Dr. W. A. **Cunnington.** The collection contained specimens from both Nyasa and Tanganyika. Including a few individuals which had hitherto passed without notice in the collection of the British Museum, there were now on record three species from Nyasa and five from Tanganyika. Of these species, three were described as new. The forms from Nyasa all belonged to the widely distributed subgenus Potamonautes; but while two species from Tanganyika also belonged to that subgenus, the lake contained three species belonging to the remarkable endemic genus Platythelphusa, A. Milne-Edwards. The suggested marine appearance of *P. armata* was considered to be only superficial, and the peculiar character of the Brachyuran fauna of Tanganyika could be explained on the grounds of a prolonged isolation of the lake.—Two new species of African oligochæte worms of the genus Microchætus belonging to the collection of the Christiania Museum: F. E. **Beddard.**

Physical Society, March 8.—Prof. J. Perry, F.R.S., president, in the chair.—The rate of recovery of residual charge in electric condensers: Prof. F. T. **Trouton** and S. **Russ.** The experiments described by the authors were undertaken in order to examine the rate of recovery of residual charge when the difference in potential of the plates is kept constant. Previous experimenters have always allowed the charge to accumulate on the plates while observing the rate of rise in potential. In that case the recovery meets with an ever-increasing opposition which complicates matters. The authors have employed two methods. In the first, which was used with mica condensers, the potential, observed by an electrometer, was kept constant by means of a variable resistance which was gradually increased as the recovery current diminished. The high resistance necessary was constructed of two horizontal metal plates with ionised air between them. A movable shutter could be introduced between the plates to diminish gradually the cross-section of the air resistance as required. The second method was used when the residual charge was great enough. In it the current was passed through a dead-beat galvanometer, and the value of the recovery current at each moment determined. In this case the difference of potential of the plates may be taken as constant since it was practically zero. The observations when plotted with current against time were found to lie on a hyperbola. This shows that in the circumstances of the experiments the quantity of electricity recovered up to any given time follows a law $Q=a\log(p+t)$ similar to that found by Rankine and others for the recovery of stress in over-strained elastic bodies when the strain is kept constant.

MANCHESTER.

Literary and Philosophical Society, February 12.—Mr. Francis Nicholson in the chair.—Some tables for explaining the nature of statistical correlation: A. D. **Darbishire.** The thirteen tables exhibited graphically the results of thirteen series of pairs of throws of dice in such a way that the effect of increasing the correlation between the first and second throws of the pair was clearly seen. The method is an application, to some new sets of throws, of Weldon's beautiful device for illustrating statistical correlation.

February 26.—Prof. H. B. Dixon, F.R.S., in the chair.—Report on the recent Foraminifera from the coast of the Island of Delos (Grecian Archipelago), part iv.: H. **Sidebottom.** Drawings of some of the more interesting species were exhibited, and mounted specimens were shown under the microscope.—The leaves of Passerina: Madeline **Carson.** The Passerinæ belong to the natural order Thymelæaceæ. These plants inhabit the warm dry regions of Egypt, South Africa, and the Mediterranean. They are common on the sand hills near the coast, and always live under conditions in which there is a difficulty of obtaining water. In order to combat against this, they are specially modified. The leaf surface is reduced, often the leaves are imbricating. They are provided with a very thick cuticle, have the edges inrolled, and the stomates are found only on the inner surface. They are further protected by a covering of hairs. The chief object of the study of these leaves was to discover whether the epidermal cells contained mucilage or not. In *Passerina filiformis* and in *P. hirsuta,* the author found that in many of the epidermal cells a portion was cut off from the rest by a cellulose wall. The upper portion contained tannin and probably mucilaginous sap, while the lower portion consisted of hard stratified mucilage. In the other species examined, *Passerina ericoides* and *P. rigida,* no trace was found of separation of the epidermal cells into a striated and non-striated portion. The whole epidermal cell stained with mucilage stains and tannin stains. Since mucilage and tannin both act in the same way towards methylene blue, and since it is impossible to separate tannin and mucilage, the evidence for the presence of mucilage in these species is not perfectly conclusive. As, however, mucilage is without doubt found in some Passerinæ, its absence is not characteristic of the group, and therefore its presence or absence can no longer be used as a basis for classification of the Thymelæaceæ.

PARIS.

Academy of Sciences, March 18.—M. A. Chauveau in the chair.—A property of platinum amalgam: H. **Moissan.** When platinum amalgam is shaken with water, a semi-solid mass of the consistency of butter is formed. This appears to be permanent, since the volume does not change after keeping for one year, and the mass can be heated to 100° C. without destroying it. Amalgams of copper, silver, or gold do not produce a similar emulsion, but separate in precisely the same fashion as pure mercury.—The wax from the palm *Raphia Ruffia*, of Madagascar, and on arachic alcohol: A. **Haller.** An alcohol possessing the formula $C_{20}H_{42}O$ was isolated from this wax. This is the same formula as that of an alcohol isolated by M. Étard from lucerne, but a comparison of the two showed that they were not identical. The acetic and benzoic esters of the new alcohol were prepared, and also a hydrocarbon by treating with anhydrous zinc chloride. Arachic alcohol was also prepared, and found to be not identical with the alcohol under examination.—The existence of parameters capable of characterising the magmas of a family of eruptive rocks: Michel **Lévy.** Having a set of fifty analyses of rocks of the Mont-Doré series, in which particular care had been given to the determination of the alumina and the separation of the alkalis, the author has worked out a set of the various parameters to characterise rocks, the most stable of all being that which represents the latent acidity,

$$\phi = \frac{S_{sal}}{2k+3n},$$

where S_{sal} represents the silica of the white elements and $2k+3n$ a number sensibly proportional to the sum of the atomic weights of the alkalis.—The modifications introduced by the pathological state in the immediate destinations of the nitrogenous elements: A. **Chauveau.**—Observations of the Giacobini comet (1907*a*) made with the large equatorial of the Observatory of Bordeaux: Ernest **Esclangon.** The comet had the appearance of a feeble nebulosity with a clearly defined nucleus. The apparent positions of the comet and mean positions of the comparison stars are given for March 12 and 13.—Observations of the Giacobini comet (1907*a*) made at the Observatory of Algiers with the 31·8 cm. *coudé* equatorial: MM. **Rambaud** and **Sy.** Similar observations made on March 11, 13, and 14. The comet appeared to be circular, with a diameter of about one minute of arc. The central condensation was 5″ diameter, with a brightness corresponding to a star of the 11·5 magnitude.—Elements of the Giacobini comet (1907*a*): Paul **Brück.**—Observations of the Giacobini comet (1907*a*) made with the *coudé* equatorial at the Observatory of Besançon: P. **Chofardet.** Similar observations for March 12, 14, and 16.—The new Giacobini comet: M. **Giacobini.**—Orthogonal systems of functions: Frédéric **Riesz.**—Periodic solutions of linear differential equations: T. **Lalesco.**—The problem of Dirichlet: H. **Lebesgue.**—A surface of the sixth order related to Abelian functions of the third genus: L. **Remy.**—Helices considered as generators of a surface: G. **Barré.**—The method of isoperimeters: G. **Hilleret.** An application of the method of isoperimeters to the rapid approximation of π.—Aëroplanes: A. **Étévê.**—Waves of shock and of spherical combustion: M. **Jouguet.**—The origin of spectra in series: W. **Ritz.** It is known that the frequencies ν of the ordinary spectrum of hydrogen and of the new spectrum discovered by Pickering in certain stars are given very exactly by the formulæ

$$\nu = N\left(\frac{1}{4} - \frac{1}{m_2}\right), \quad \nu = N\left[\frac{1}{4} - \frac{1}{\left(m-\frac{1}{2}\right)^2}\right], \quad (m = 3, 4, 5, \ldots);$$

where N is a constant. An outline of a physical system is here given which it is shown would give rise to just such a system of vibrations.—The ionisation of the chromium sulphates: Albert **Colson.** In the chromium sulphates the lowering of the freezing point appears to be independent of the ionisation as measured by the electrical conductivity.—The alloys of nickel and tin: Em. **Vigouroux.** By directly heating together pure tin and nickel, alloys containing respectively 73·6, 83·6, and 92·7 per cent. of tin have been prepared. All three alloys are non-magnetic, and under the action of nitric acid leave a crystallised metallic residue.—The arsenites and arsenates of rubidium: A. **Bouchonnet.**—The action of *p*-*p*-tetramethyldiaminobenzylhydrol on some methylene derivatives: R. **Fosse.**—The inequality of the resistance of natural starch and artificial amylose towards extract of barley: J. **Wolff** and A. **Fernbach.** Amylose in its natural form is distinguished from artificial amylose by a much greater resistance to saccharification by extract of barley.—The influence of fertilisation on the characters of figs: Leclerc **du Sablon.** Fertilisation, which is not necessary in the varieties cultivated in France, is possible, and increases both the weight and the yield.—The development of the *pneumathodes* of the palm and on the true nature of these organs: C. L. **Gatin.**—The mode of action of tephrosin: M. **Hanriot.**—Some consequences of the interpolation of the principal experiments of M. Chauveau on muscular energetics: Charles **Henry.**—Morphological changes in the nerve cells surviving the transplantation of nerve ganglia: G. **Marinesco** and J. **Minea.**—Locomotion in the Gasteropods: Raphael **Dubois** and Fred **Vlès.**—A new sub-fossil Lemurian of Madagascar: G. **Grandidier.**—Some seismic constants deduced from the earthquake of April 4, 1904: E. **Oddone.**

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